MANURES

B 2.11/1

Rates per acre of artificial manures:

Ammonium Sulphate	1 cwt.
Superphophate	2 cwt.
Plutophos	1 cwt.
Potassium Chloride	½ cwt.
Calcium Cyanamide	1½ cwt.
Basic Slag	2 cwt.

Complete mixture is Amm. Sulph + Superphophate + Pot. Chloride, but the last can be omitted. Plutophos can be used in place of Superphophate if half the quantity is used.

Opium Refuse as Manure.

Owing to the very rapid increase in the price of cowdung as well as the great difficulties in obtaining it, various substitutes have been under trial in this garden since the year 1920, Opium Refuse (Ganja) being one of them. By burying deeply in the soil or by mixing it with cowdung so as to innoculate it with bacteria, its decomposition it was thought, would be sufficiently rapid (Rept. Bot. Gardens, 1920, p. 2). Although this substance was under observation since that year, definite experiments could be undertaken only in the second half of the year 1923, and then too, owing to the closing of the Economic Gardens, only a preliminary trials could be made. The following is a report on these trials.

Plot Experiments

Two contiguous plots of fairly uniform character were chosen. On one some rubbish was burnt and the ash removed some two months previous to its preparation for the present experiments*, while the other was not treated at all. Both were fallow for more than six months and no manure was used on them for more than a year. After having been cleared of all weeds, each of these plots was properly tilled and divided into four beds, each measuring 19x3 feet at the top of the bed (for the bed had slanting slopes), and 3/4 ft. deep. Trenches, each measuring 3/4 ft. between, and parallel to the length of the beds, were made to run round the beds and were provided with outlets on both sides so that the drainage water from the beds may be quickly removed off. In each plot a bed was kept unmanured as control, while the other three beds were manured with old opium refuse, fresh refuse and cowdung, and mixed with black surface soil respectively, at the rate of one and half rubbish basket per bed. The old opium refuse had been buried deep for some two years mixed with leaf-mould in alternate layers; when it was dug out not trace of leaves could be detected with a naked eye and refuse had formed into a hard cake. It had, therefore, to be pounded to bits before it could be used as a manure. The fresh opium refuse was

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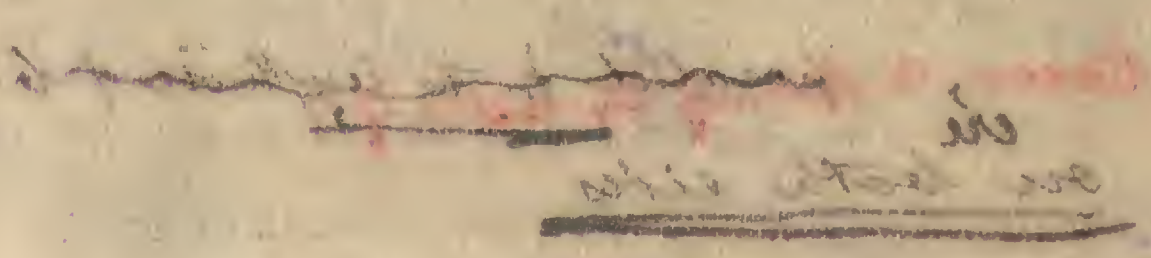
* The information regarding the previous treatment of the plots and the old refuse was supplied by the late foreman-gardener of the Economic Garden.



mixed with equal quantities of black surface soil rich in organic matter and was kept buried for two days before it was used. The cowdung used was partly dry and had very little of grass mixed with it. These substances were spread on their respective beds and lightly forked in so as to mix it with the soil. Each bed was then planted with twenty ten-days-old amarantnus seedlings (the Indian spinach). Excepting the rainy days, the beds were watered regularly every evening, kept clean of weeds and once forked eighteen days after transplanting. Throughout the experiment one could note from the sickly growth that the plants were worse off due to the opium refuse manure than the ones with no manure, the injurious effect of the fresh chando being more marked than that of the old one. Some plants on the beds with opium refuse died and were replaced with fresh ones of nearly equal size. A leaf roller pest occurred but the insects were handpicked from time to time as they appeared. The plants manured with chando were the ones most subject to the attacks by the insects, while the plants manured with cowdung manure were almost free.

Six weeks after transplanting the plants were carefully uprooted so as to injure the roots as little as possible, washed off to remove all the earth at the roots, and were weight. It was found that the opium refuse, both old and fresh, had distinctly decreased the yield as could be seen by comparing the yield of the control plot (vide Table I). An examination of the roots growth showed that the plants with opium refuse had made very little of surface root growth and that there were only a few roots which went straight downwards. The root growth of plants manured with old opium refuse was little better than that of the plants with fresh refuse, but was very much poorer than the root growth of the plants grown on check plots or beds manured with cowdung. Their roots too had very little of surface root growth and root hairs, nearly all the roots showed a downward tendency. There was very little difference between the root growths of plants grown on check plots and those plots manured with cowdung, except that the former had longer surface root growth, while the latter had more roots growing lower down in the soil.

After the harvest of the crop, the beds were fallowed

for a period of twelve days

for perid̄d of twelve days during wnicn tney were forked five times and received copious watering fxmmx by frequent showers of rain. The beds were then replented witn ten-days old amarantnus seedlings. During tne early life of tne plants one could again note tne narmful effect of tne opium refuse on tne plants. Furtner observations on tnese plants nad to be discontinued as too many insect parasites began to encroacn on tnese beds from weeds in tne suurounding areas the cultivation of wnicn xmm nad been abandoned.

Pot Experiments

Another set of experiments were made in pots to test tne manurial value of opium refuse wnen mixed with well-rotten leaf-mould. For tnis purpose surface soil was taken from a completely fx fallow locality and was mixed one-tnird witn river sand so as to improve its pnysical condition. This set constituted of pots witn chando, leaf-mould, and cnando mixed with equal quantity of leaf-mould. The quantity of menure used was one-tnird of tne soil by volume, and tne plants selected for tnese experiments were (one plant per pot) cosmos. Here too it was observed tnat tne old opium refuse nad exerted a very injurious influence botn on tne plant growtn and flower production, and this was so even wnen tne opium refuse was mixed witn leaf-mould (vide table II).

Side by side witn tnese trials another tests, pot tests were made to test tne extract from opium refuse taken by macerating it for 24 nours in double tne quantity of water, was more narmfull

Side by side witn tnese tests, anotner trials were made in wnicn the opium refuse was macerated in double tne quantity of water for 24 nours, and tne liquid extract obtained by straining tnrough a gunny bag and tne residue were used in separate pots. In tnese tests in which only four plants were it was found tnat botn tne residue and tne liquid extract were narmful to tne life of plants, tnough it appeared tnat solid residue was more narmful tnan its liquid extract, probably because of the fact that tne latter was susceptible to be more easily washed away by drainage water and that there were frequent showers of rains during the growth of the plants.

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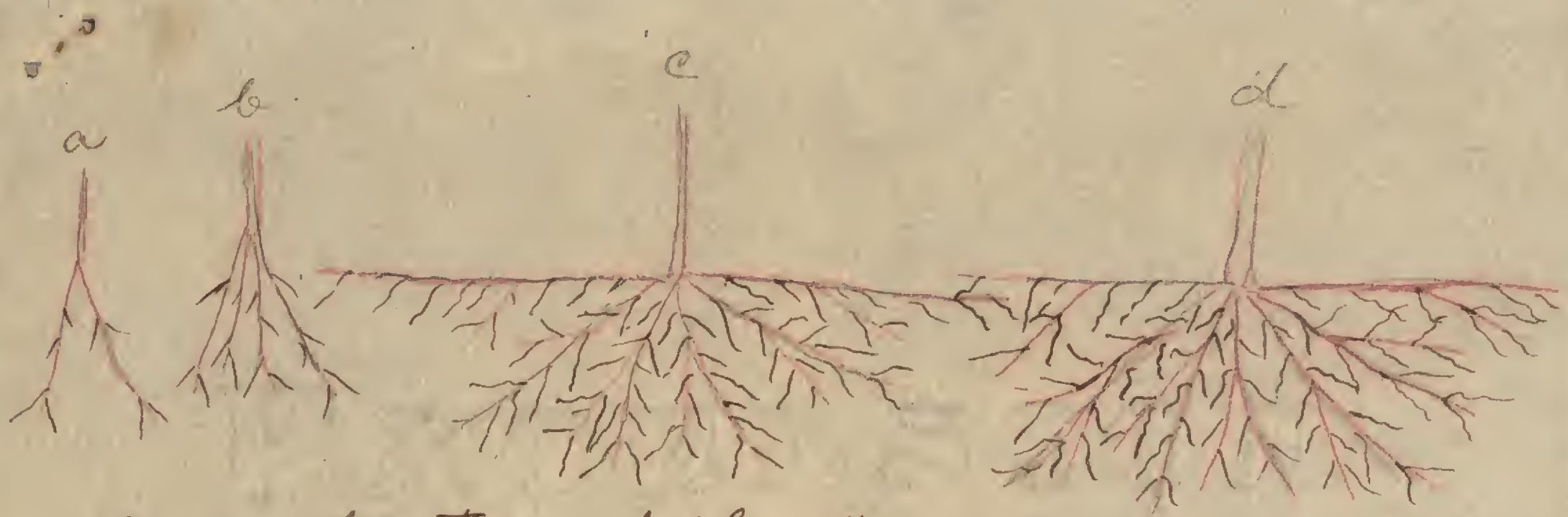
From the foergoing results it appears that the opium refuse is not decomposed as easily as it was thought first and that it is no good as a manure unless it is subjected to some treatment other than merely burying it either alone or mixed with soil, leaf-mould, etc.



(a) = rootsystem of plants growing on fresh chaunk

(b) " " " " old chaunk

(c) " " " " no manure

(d) " " " " cowdung.

Table I

Beds	Old Opium refuse	Fresh opium refuse	Cow-manure	Control
Burnt Plot	13 lbs.	5½ lbs.[a]	33½ lbs.	20 lbs.
Unburnt plot	8½ lbs.[b]	4¼ lbs.[c]	22 lbs.	12 lbs.
Total	21½ lbs.	9¾ lbs.	55½ lbs.	32 lbs.

a Five plants had died in this plot and new ones substituted.

b only one had died and was substituted.

c- ditto.

Table II

Plants	Height measurements 1	2	3	4	5	6	7	8	Total weight	Average weight
A Chando and leaf-mould	27-	20	37	13[a]	30	23	34	17	6¾	.844
B Chando	29	20	34	35	23	20	25	30	6⅛	.766
C Leaf-mould	35	50	50	41	36	33			15	2.5

The height measurements are in inches and the weight in ounces. Plants in series A and B had very few branches and few flowers, and most of the plants looked very sickly. All plants in series C were vigorous and many branches and flowers.

a This plant was dying.

B 2.11/8

Department is not altered by the current proposal that the Director of Gardens should have his centre of work in Kuala Lumpor because the proposal does not extend to moving the Assistant Director, who, resident in Singapore, will in my plans carry on his study of the Cryptogams in the laboratory that we have prepared for him, and no one in the country will be better than he in knowledge of foreign fungus pests while as a horticultural officer he is compelled to know insect pests and as an observer of disease in plants to be experienced in diagnosing injury to vegetation of all kinds. From the Gardens, when notified by your preventive service of the arrival of plants to be inspected, he will proceed to the docks or other place to examine the consignment and will admit, refuse admittance or quarantine them as necessary.

5. He will establish a small quarantine observation plant house in Singapore.

6. Entry or exit of plants into or from Penang would have to be controlled by the Assistant Curator; and that officer in difficulties would refer to higher officers in this Department. He also will need a small quarantine plant house.

7. I do not believe that your post officers are ready at the moment to exercise any discretion in stopping forbidden vegetation from entry. They must be taught these duties or our orders are useless. They must be taught to report by telephone to the proper authority when any material arrives which seems possibly prohibited.

I have the honour to be,
Sir,
Your obedient Servant,

Sgd. I.H. Burkill

Director of Gardens

The Honourable the
Colonial Secretary
Singapore

B 2.11/9

B2.11/10